

May 17, 1927.

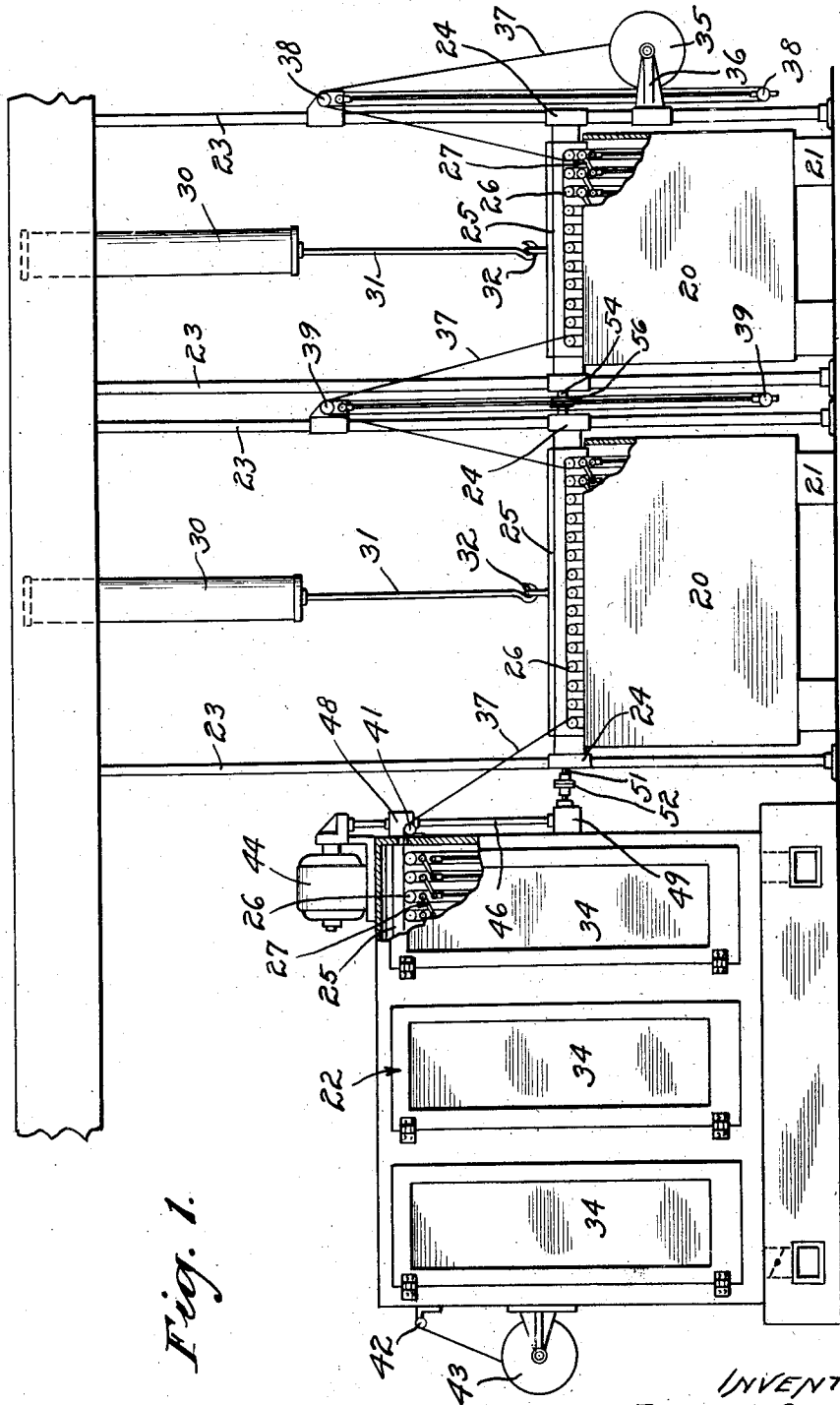
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1,629,030

AUTOMATIC FILM TENSIONING MECHANISM HAVING INDIVIDUAL SPOOLS

Filed March 2, 1926

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

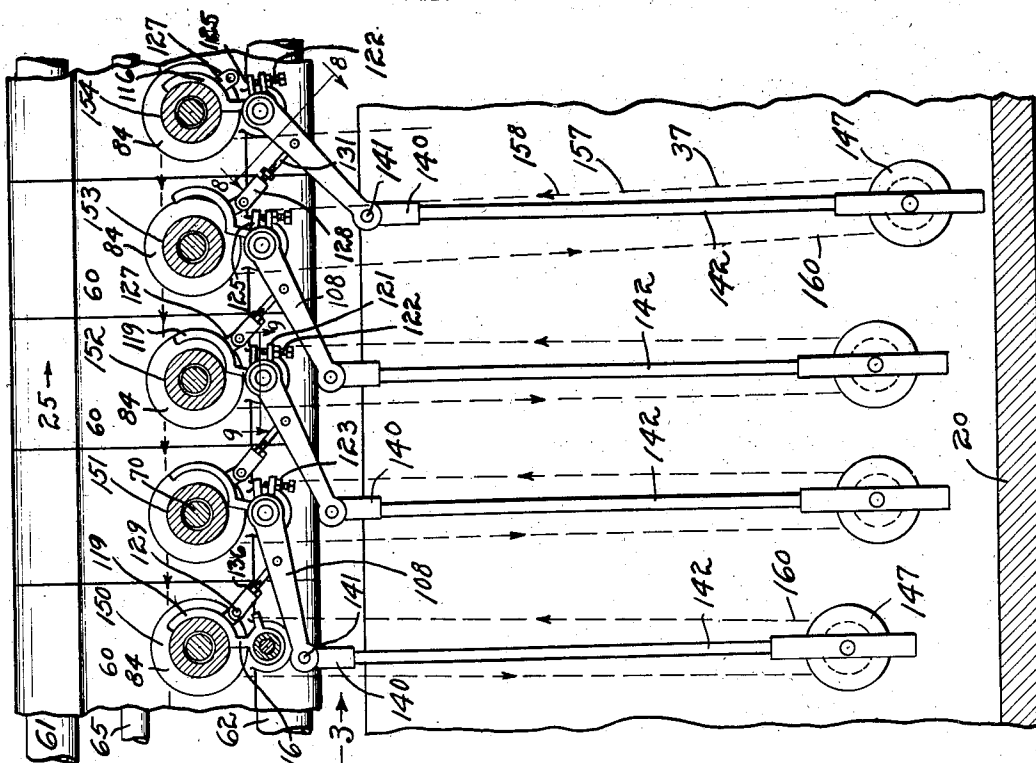


Fig. 2.

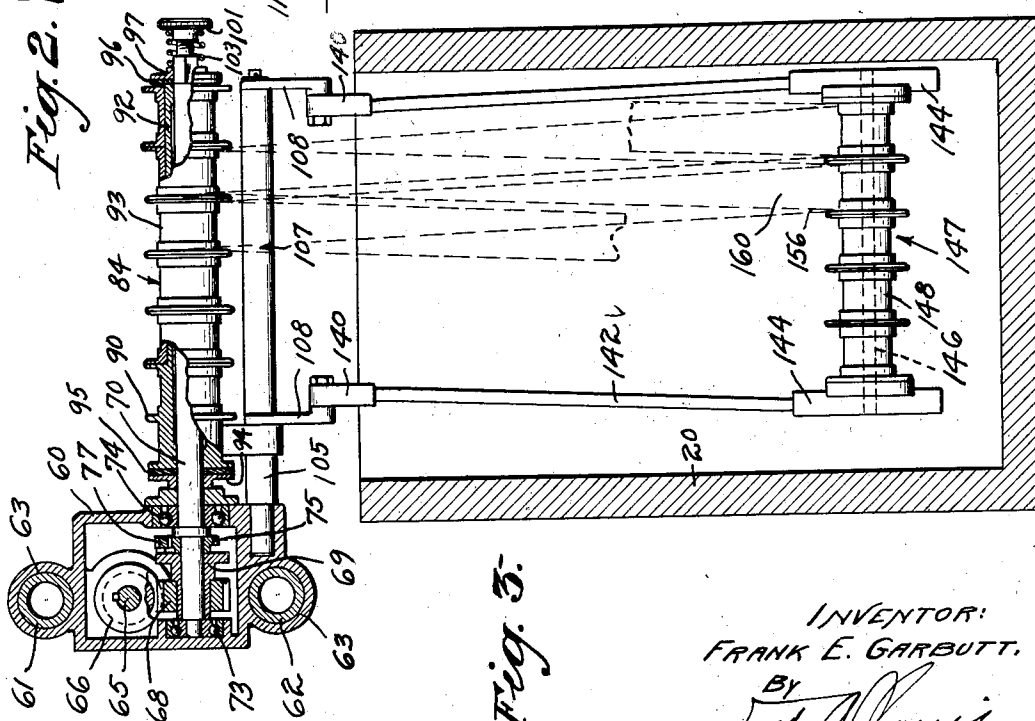


Fig. 3.

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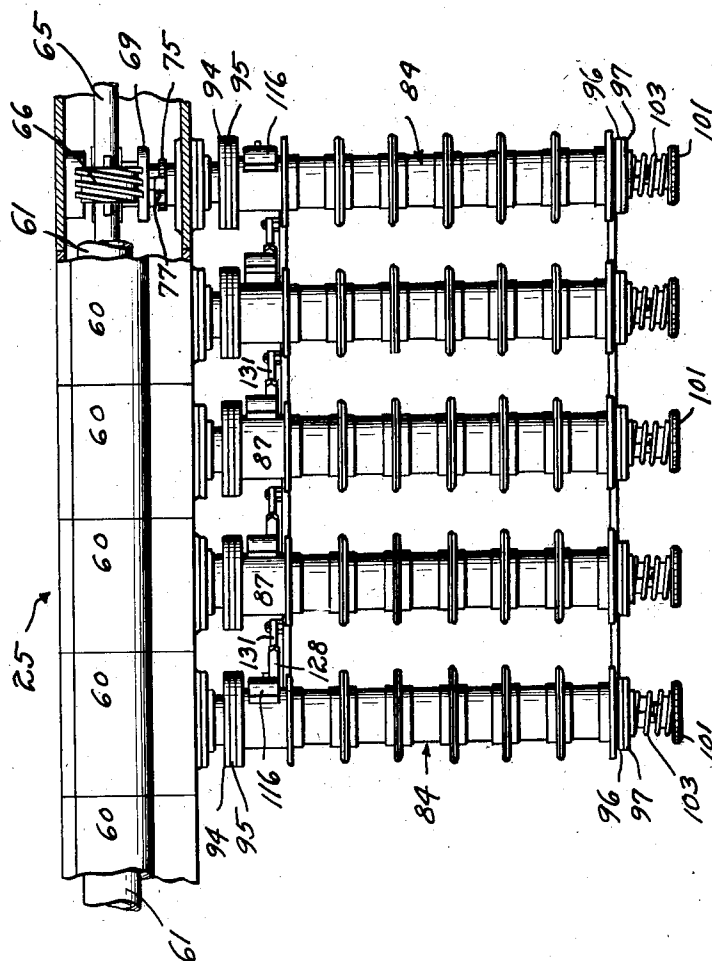
1,629,030

AUTOMATIC FILM TENSIONING MECHANISM HAVING INDIVIDUAL SPOOLS

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4 Sheets-Sheet 3

Fig. 4.



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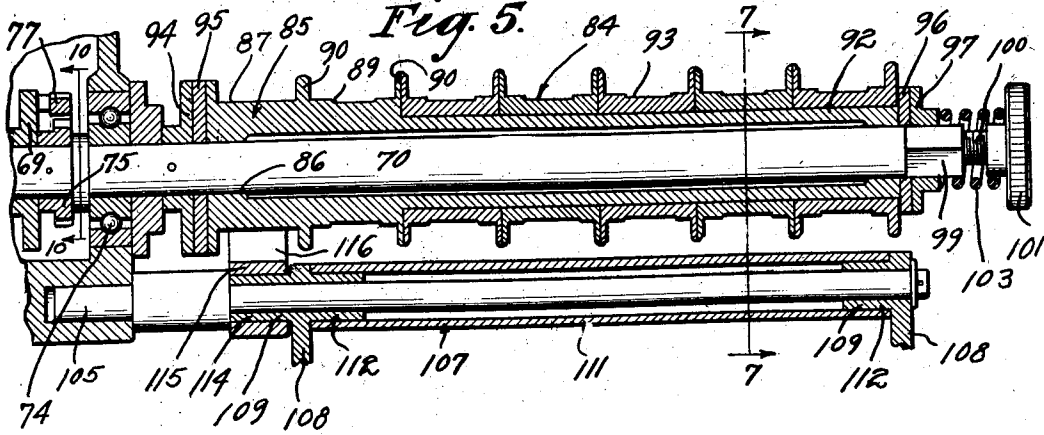
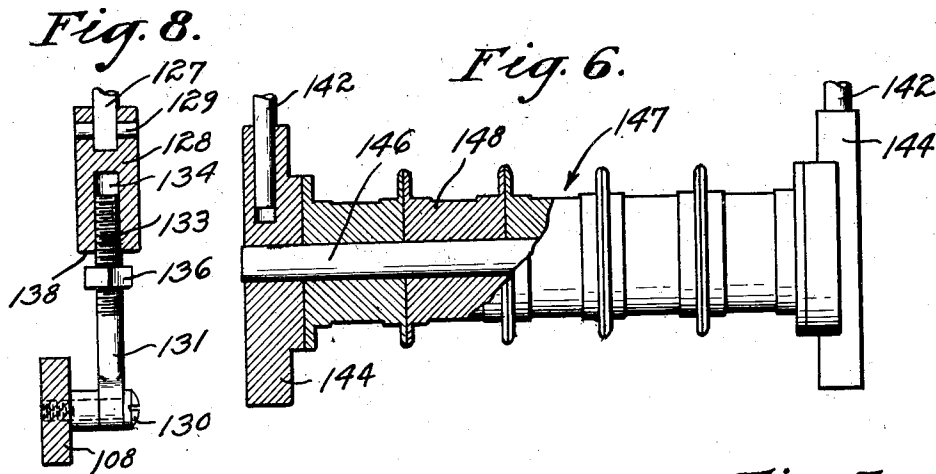
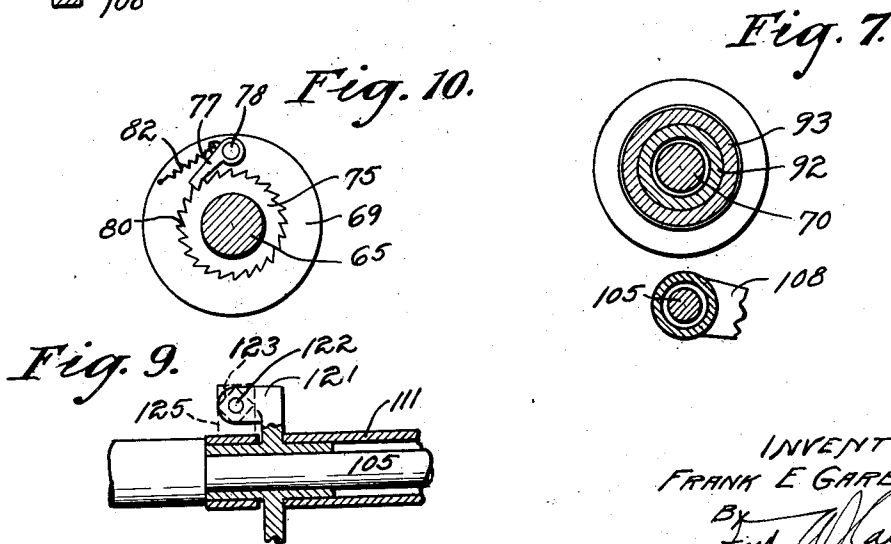
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AUTOMATIC FILM TENSIONING MECHANISM HAVING INDIVIDUAL SPOOLS

Filed March 2, 1926

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE.

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AUTOMATIC FILM-TENSIONING MECHANISM HAVING INDIVIDUAL SPOOLS.

Application filed March 2, 1926. Serial No. 91,698.

This invention relates to the art of developing photographic film, and it relates particularly to an automatic developing machine especially suitable for developing motion picture film.

In this art both positive and negative films are subjected to a series of consecutive treatments after their exposure, which prepares them for the cutting room. Film generally passes through the following steps. The film is first developed by immersion in a developing solution; it is then passed through fixation solutions by which the images are fixed thereupon. The film is then washed to remove all adhering solutions. The film is then dyed and toned for emphasizing the images and finally the film is dried, it being then ready for the cutting room. Motion picture film is carried through these series of treatments either manually or by automatic machines.

My invention particularly relates to automatic machines for conveying film through these treatments. There are at the present time automatic machines for developing film which comprise the various solution tanks and drying compartments. In these tanks and drying compartments are series of rollers over which the film is wound. The film is fed into one end of the machine, passing over the rollers through the various solutions and through the drying compartments. The film passes from the machine in a condition ready to go to the cutting room. The film may be developed by machine very quickly and comparatively cheap. The extensive use of these automatic machines, however, has been restrained due to difficulty being encountered as a result of stretch and shrink of the film from a normal condition. It has been found that the film when passing through various solutions and drying compartments will stretch or shrink from normal condition sometimes as much as $\frac{3}{8}$ ths of an inch in 50 feet. A shrinkage of the film increases the tension thereof and places considerable strain thereon. This strain, if great enough, will cause the film to break, thus causing considerable delay. This is also sometimes very expensive due to the fact that very important scenes are sometimes ruined which, if ruined on the negative, must be photographed again. Also when the film stretches there is a liability of this film running off the rollers and tangling, which obviously neces-

sitates the shutting down of the machine, causing considerable delay and sometimes causing a great deal of expense.

It is an object of my invention to provide an automatic film developing machine having a means for automatically maintaining the film at a normal tension.

It is another object of my invention to provide in an automatic film developing machine of this character an automatic tension regulating means which controls the rate of travel to either side of the place where an abnormal tension in the film exists, thereby rectifying this abnormal tension. I provide my invention in the form of a plurality of series of rollers comprising upper and lower rollers. The film is consecutively wound over these successive series of rollers. On one roller of each series of rollers I provide an arrangement whereby the rotation of speed of this roller may be varied with respect to the rotation of speed of other rollers. This means is adapted to be operated by the film when an abnormal tension exists, in such a manner as to readjust this tension to normal.

It is another object of my invention to provide an automatic film developing machine having automatic tensioning means which is operable by lower rollers of said series of rollers. This object is accomplished by providing lower rollers which are floating and which are arranged to be supported by the film. These rollers are each connected with an arrangement which is operable to retard the rotation of speed of the upper rollers of the plurality of series of rollers. When the tension in the film increases above normal the floating or lower rollers are raised, and when the tension decreases below normal the floating rollers are lowered. The raising or lowering of the floating rollers from a normal position actuates the mechanism associated with the upper rollers in such a manner as to rectify this abnormal tension and to return the floating rollers to a normal position.

In my arrangement, the raising of one of the floating rollers actuates the tensioning mechanism associated with this series of rollers in such a manner as to retard the exhausting of the film from this series of rollers in which the floating rollers have been raised. This retarding gives more film to this series of rollers and reduces the tension of the film at this place, thus allowing the

floating roller to return to normal position. When the floating roller of the series of lower rollers is below normal position, the tensioning mechanism of the preceding series of rollers is actuated in such a manner as to reduce the rate of feed of the film into this series in which the floating roller has lowered, and in which the tension of the film has reduced below normal. The film exhausts from this series at the same rate of speed but is fed thereto at a slower rate of speed. In this manner the tension in the film is increased to normal and the floating roller is returned to normal.

It is another object of my invention to provide a film developing machine of this character having a plurality of series of adjustable rollers, which adjustable rollers have spools which are individually adjustable relative to the rollers. The film is wound over each of the rollers a number of times, that is, it is wound on each of the separate spools so that each series of rollers contains a number of loops of film. By providing each series of rollers in the form of separate cooperating independent spools it is possible to retain the tension in each separate loop of each series of rollers at the same tension. It has been found from experience that when the rollers are made integral, each loop of the film wound on each series of rollers tends to equalize in tension, but this is possible only through a slippage of the film on the rollers. By providing these rollers with individual spools it is possible for the tension of the film to equalize in each loop without any slippage or strain whatsoever.

My co-pending application upon an automatic film tensioning mechanism, Serial No. 91,697, filed March 2nd, 1926, discloses an apparatus having the same general purpose as the apparatus of this invention.

Other objects and the especial advantages of my invention will appear in the following description.

Referring to the four sheets of drawings in which I illustrate a preferred form of my invention,

Fig. 1 is an extremely diagrammatic view illustrating the utility of my invention.

Fig. 2 is a fragmentary view showing a typical construction of my invention.

Fig. 3 is a view taken as indicated by the arrow 3 of Fig. 2.

Fig. 4 is a plan view of Figs. 2 and 3.

Fig. 5 is an enlarged sectional view taken through an upper roller of an apparatus having the features of my invention.

Fig. 6 is a partially sectioned view taken through a lower roller of an apparatus having the features of my invention.

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 5.

Fig. 8 is an enlarged detail section taken as indicated by the line 8—8 of Fig. 2.

Fig. 9 is an enlarged detail section taken substantially as indicated by the line 9—9 of Fig. 2.

Fig. 10 is a detail section taken as indicated by the line 10—10 of Fig. 5.

With particular reference to Fig. 1, a film developing machine in which my invention may be utilized comprises solution tanks 20 which contain the customary developing, fixative, washing, dyeing and toning solutions. The tanks 20 may be supported from the floor on suitable blocks 21. Adjacent to the tanks 20 is a dryer 22 into which the film is extended for drying. Columns 23 extend upwardly on each side of the solution tanks 20 and slides 24 of frames 25 are slid thereupon. These frames 25 carry a multiplicity of series of rollers 26, on which film tensioning mechanism 27 having the features of my invention is arranged. In the dryer 22 is also arranged a multiplicity of series of rollers 26 having my tensioning mechanism 27 incorporated therein. Elevators or jacks 30 are provided from which there extend rods 31 which attach to the frames 25 of the tanks 20 at 32. The jacks 30 are operable in such a manner as to elevate the frames 25 to permit a convenient threading of a film around the series of rollers 26. The series of rollers 26 in the dryer 22 are accessible through doors 34.

The positive or the negative film after it has been exposed is placed on a reel 35 which is supported by a bracket 36. The film, as indicated at 37, extends around rollers 38 which are supported on the right hand column 23 of the right hand solution tank 20. After passing around these rollers 38 the film is extended to and consecutively wound around the series of rollers 26 of the right hand solution tank 20. The film 37 is then carried, as shown, over rollers 39 which are supported by the right hand column 23 of the left hand tank 20. From these rollers 39 the film is wound around the series of rollers 26 in the left hand tank 20. From the series of rollers in the left hand tank 20 the film 37 passes over a roller 41 and is then wound on the series of rollers 26 in the dryer 22. The film passes from the dryer 22 over a roller 42, and is then wound on a reel 43, being at this time ready for the cutting room. The various series of rollers in the tanks 20 and the dryer 22 are driven by a motor 44. The motor 44 drives a shaft 46. This shaft 46 is associated with a gear box 48 which drives a drive shaft, not shown, of the frame 25 in the dryer 22. A gear box 49 is associated with the shaft 46 at the lower end thereof and drives a shaft 51 of the frame 25 of the left hand solution tank 20 through a coupling 52. The drive shaft 54 of the

frame 25 of the right hand tank 20 is driven from the shaft 51 by a coupling 56. When either of the frames 25 in the tanks 20 is elevated, it is necessary to detach either the coupling 52 or the coupling 56 or both.

The detailed construction of my invention is very clearly shown in Figs. 2 to 10 inclusive. With reference particularly to these figures, the frames 25 are provided in the form of a plurality of individual housings 60 which are supported adjacent to each other by bars 61 and 62 which extend through circular formations 63 thereof. The drive shaft for the frames 25 is typically represented by a drive shaft 65 in Figs. 2 to 10 of the drawings. The drive shaft 65 extends through each of the housings 60 and has a drive gear 66 located inside each of these housings 60. Meshing with each of the drive gears 66 is a gear 68, each of which gears 68 is rigidly secured to a member 69. Each member 69 is rotatable on an upper shaft 70, there being an upper shaft 70 supported in each of the housings 60 by bearings 73 and 74. A ratchet wheel 75 is rigidly secured to each of the shafts 70, and as shown in Fig. 10 a pawl 77 is pivoted at 78 to each of the members 69. Each pawl 77 is arranged to be retained in engagement with one of the teeth 80 of an adjacent ratchet wheel 75 by a spring 82. When the shaft 65 is rotated, each of the gears 66 drives a gear 68. The gears 68 each drives a member 69 which by reason of an engagement between a pawl 77 and the teeth 80 drive an adjacent ratchet wheel 75, thus rotating each of the shafts 70 in a counter-clockwise direction. By providing each of the shafts 70 with a ratchet arranged as shown, they may be separately adjusted during the threading of a film on the apparatus. This, however, will be described later.

As shown in Fig. 5 an upper roller 84 is carried upon each of the shafts 70. Each of the upper rollers 84 is provided in the form of a sleeve 85 having a central opening 86 through which an upper shaft 70 extends. A brake drum 87 is formed at the extreme inner or leftward end of each of the sleeves 85 and adjacent to the brake drum 87 of each of the sleeves 85 is a drive spool 89 which is defined by radial annular walls 90. On the tubular portion 92 of each of the sleeves 85, a plurality of upper spools 93 is arranged. These upper spools 93 are individually rotatable with respect to each other and with respect to each of the sleeves 85. An inner friction plate 94 is rigidly secured to each of the shafts 70 adjacent to the inner ends of each of the sleeves 85. Between each of the inner friction plates 94 and the inner ends of each of the sleeves 85 is a friction disc 95. Engaging with the outer end of each of the sleeves 85 is a fric-

tion disc 96 which is forced into engagement therewith by an outer friction plate 97. Each of the outer friction plates 97 is disposed on a squared portion 99 provided near the outer ends of each of the shafts 70. A threaded portion 100 is provided at the outer end of each of the shafts 70 on which a wheel 101 is threadedly attached. Each wheel 101 is adapted to compress a spring 103 against an adjacent outer friction plate 97. This serves to force the outer disc 96 pressurably into engagement with the outer end of a sleeve 85 and to force a sleeve 85 pressurably into engagement with a disc 95. This arrangement frictionally rotates each of the sleeves 85 with an upper shaft 70 by which it is carried. The pronounced value of this arrangement and the value of the individual spool arrangement will be described later.

A support shaft 105 extends outwardly from each of the housings 60 directly below each of the shafts 70. A brake actuator 107 is carried by each of the support shafts 105. The brake actuators 107 each comprises brake levers 108 having hubs 109 which surround a shaft 105. A tube 111 extends between the levers 108 of each of the actuators 107, each of the tubes 111 being extended on hub projections 112 of the pair of levers 108 of each of the actuators 107. On a hub projection 114 of each of the inner levers 108, a hub 115 of a brake shoe 116 is carried. A shoe portion 119 of each of the brake shoes 116 extends, as shown in Fig. 2, into such a position as to be capable of engagement with a brake drum 87 of a sleeve 85 situated directly above the rod 105 on which it is supported.

As shown in Figs. 2 and 9, on each of the inner levers 108 of the brake actuators 107 a lug 121 is formed through which an engagement pin 122 is adjustably threaded, each of the engagement pins 122 being locked in a set position by a nut 123. Each of the brake shoes 116 is provided with a dog 125 which is so positioned as to be engageable by an engagement pin 122 of an actuator 107 supported therebelow. An ear 127 is formed on each of the brake shoes 116, as shown in Figs. 2 and 8 of the drawings. Pivoted to each of the ears 127 is a block 128, each block 128 being pivoted to an ear 127 by means of a pin 129. Pivoted to each of the inner levers 108 by means of a pin 130 is a rod 131. The extending end 133 of each of the rods 131 is threaded and is extended into an opening 134 of an adjacent block 128. A nut 136 is threaded onto each of the threaded ends 133 of each of the rods 131.

When a brake actuator is moved downwardly, that is, when the levers 108 are swung downwardly, the engagement pin 122 thereof moves into engagement with the dog

125 of the upper brake shoe 116, that is, with the brake shoe operating thereabove in such a manner as to cause the upper brake shoe 116 to engage the brake drum 87 of the upper sleeve 85. When an actuator is moved upwardly, that is, when the levers 108 are swung upwardly, the nut 136 of the rod 131 pivoted thereto engages with a lower face 138 of a block 128 of a following brake shoe 116, that is, a brake shoe 116 which operates on a sleeve 85 to the left of the sleeve under which the actuator is pivoted. This applies the following brake shoe 116 to the brake drum 87 of the following sleeve 85.

By the terms "upper roller" or "upper brake shoe" is meant a roller or brake shoe which is situated above the pivot of an actuator 107 which is being discussed, and by the terms "following roller" or "following brake shoe" is meant a roller or brake shoe to the left of the point at which the actuator 107 being discussed is pivoted.

As is evident from Fig. 2 of the drawings, the levers 108 of each of the actuators 107 extend laterally and have a connector 140 pivoted thereto at 141. Each of the levers 108 terminates below a following roller 85. A rod 142 extends downwardly from each of the connectors 140 and has a block 144 secured at the lower end thereof. A pair of blocks supported from inner and outer levers 108 of an actuator 107 cooperate to support a lower shaft 146. On each of the lower shafts 146 is carried a lower roller 147, each of these lower rollers 147 being comprised of individual lower spools 148. Each of the spools 148 is separately rotatable with respect to each other and with respect to the shaft 146 by which these spools are carried. Each of the shafts 146 is carried by an actuator 107 of a preceding upper roller 84. Each of the upper rollers 84 combines with a lower roller 147 to provide a series of rollers.

In Fig. 2 I illustrate series of rollers 150, 151, 152, 153 and 154, each series being comprised of an upper roller 84 and a lower roller 147. The lower rollers 147 are entirely supported by one of the actuators 107 and a movement in a lower roller 147 serves to move an actuator 107 by which it is supported. The film 37 is wound successively over each of the spools of the upper roller 84 and over each of the spools of the lower rollers 147 as indicated by the dotted lines 156 of Fig. 3. The film passes from each of the series of rollers as indicated by the dotted lines 157 of Fig. 2 and travels in a direction indicated by arrows 158 of Fig. 2.

When the apparatus as shown in Fig. 1 is put into operation the frames of the tanks 20 are raised so that a leader may be threaded over the series of rollers 26 thereof, it being necessary to detach the couplings 52 and 56 as previously described. The leader

after being threaded over the frames of these tanks 20 extends into the dryer 22, and is wound on the series of rollers 26 therein, these rollers in the dryer 22 being accessible by opening the doors 34. The upper rollers being separately rotatable due to the provision of the ratchet wheel and pawl arrangements 77 and 75 permit the adjusting of this leader to a substantially normal tension at all points. After the leader has been completely threaded on the series of rollers 26 and adjusted thereon, the frames 25 of the tanks are lowered and the motor 44 is set into motion, thus rotating the upper shaft 70 and rotating the upper spools 84.

When the film is at normal tension the lower rollers 147 of each of the series of rollers are retained in such a position that none of the brake shoes 116 engage with the brake drums 87 of the sleeves 85.

With particular reference to Fig. 2, when the tension in one of the series of rollers 20 reduces below normal, the loops of film 160 of this series of rollers will lengthen and allow a lower roller of this particular series to drop below normal position. In Fig. 2 the lower roller of the series of rollers 153 is shown in a position below a normal position due to the reduction of tension of the loops 160 of film at this place. A dropping of this lower roller 147 moves the actuator 107 of the preceding series of rollers 154 in such a manner that the engagement pin 122 thereof engages the lug 125 of the brake shoe 116 of this series 154. This brings the brake shoe 116 into engagement with the brake drum 87 of the sleeve 85 of this series, thus retarding the rotation of speed of this upper roller 84 with respect to the rotation of speed of the shaft 70, and with respect to the rotation of speed of the other series of rollers. This results in a retarding of the exhausting of film from this series 154 which retards the feeding of the film 37 to the series 153. This causes a shortening of each of the loops 160 of this series of rollers 153 which increases the tension thereof and moves the lower roller 147 back to a normal position. When this roller 147 returns to normal position the brake actuator will return to a normal position, and the brake 116 of the series 154 is allowed to disengage the sleeve 85. The upper roller 84 at this time will again rotate at a normal speed.

The reduction in tension in any of the series of rollers 26 has an effect on all of the preceding series of rollers. When the brake 116 of the series of rollers 154 is applied, the exhausting of the film from this series is decreased; however, the film is fed therethrough at the same rate of speed. This lengthens the loops 160 of this series 154 which allows the lower roller 147 thereof to drop and to apply the brake of a pre-

ceding series of rollers substantially in the same manner as the lowering of the rollers 147 of the series of rollers 153 affected the series 154. The rollers preceding the initial series of rollers in which a reduction in tension exists are all successively affected; however, each successive series is affected to a less extent and the effect gradually decreases to nothing. In this manner the reduction of tension at any place in the apparatus is compensated for by a readjustment of series of rollers preceding.

When the tension in the film increases above normal, the loops 160 of a series of rollers in which the increase in tension is present shorten and consequently raise the lower roller 147 of this series above normal position. In Fig. 2 the loops 160 of the series of film 150 are shortened due to an increase in tension at this point. The lower roller 147 of the series of rollers 150 is elevated and a preceding actuator 107 is actuated thereby as shown. Elevation or raising of this actuator 107 causes the nut 136 thereof to engage the face 138 of the block 128 associated with the brake shoe 116 of the upper roller 84 of this series 150. This causes the brake shoe 116 to engage the upper roller of the series of rollers 150, thereby retarding the rotation of speed thereof. By retarding the rotation of speed of this upper roller, the speed at which the film exhausts therefrom is retarded; however, the speed at which the film is fed thereto remains the same. This feeds the film to the series of rollers 150 at a greater rate of speed than it is exhausted therefrom. Consequently, the loops 160 thereof are lengthened and the tension at this point is reduced. When the lower roller 147 of this series of rollers 150 returns to normal position the brake shoe 116 thereof is removed from engagement with the upper roller 84, and the upper roller 84 will again rotate at a normal speed.

An increase of tension of the film 37 at a series of rollers 26 affects the condition of a series of rollers following it. For example, when the tension increases at the series of rollers 150, the upper roller 84 thereof is retarded in speed. This retards the exhausting speed of the film therefrom and consequently retards the speed at which the film is fed to the following series of rollers. By reducing the feeding of film to this following series of rollers the tension thereof increases and consequently the loops of film 160 thereof shorten. This causes the lower roller of this series to raise and to apply the brake of this series in the same manner as the brake 116 of the series 150 is applied. This following series of rollers will have the same effect upon a series of rollers following it, practically the same as the effect produced on it by the series of rollers 150.

However, the effect on each of the successive following series of rollers diminishes and reduces to nothing. In this manner the increase in tension in the series of rollers is compensated for, and the film will be returned to substantially a normal tension.

In actual practice it is found that the lower rollers 147 are very seldom in normal position but are operating slightly to either side thereof; however, the tension in the film is substantially at a normal tension.

The feature of providing the upper and lower rollers 84 and 147 in the form of individual spools is a very important consideration of my invention. By this provision, it is possible for each of the loops of film 160 of each of the series of spools 26 to adjust themselves to an equal tension. For example, when the feeding of film to a series of rollers is increased, the tension of the first loop 160 is immediately reduced, and the length of this first loop is increased. This immediately places more tension in the remaining loops 160 due to the fact that the entire weight of the lower roller 147 is carried by a less number of loops 160. The spools of these loops 160 which are supporting all of the weight tend to immediately rotate faster in such a manner as to distribute the weight of the lower roller 147 over all of the loops 160 and thus equalize the tension in all of these loops. The tension of the loops of film on each of the upper spools 93 provides friction between these spools 93 and the tubular portion 92, this friction being sufficient for these spools to be driven by the tubular portion 92; however, it does not prevent a relative movement between the tubular portion 92 and the individual spools 93. Were the rollers 84 or 147 not provided with individual spools, the tension in the loops 160 would equalize after a time due to slippage of the film on the rollers; however, one or two of the loops would be made to carry an excessive weight for a period of time which would place considerable strain on the film.

When the feeding of the film into a series of rollers is retarded, the individual spools thereof vary in rotation of speed and adjust themselves so that all of the loops 160 will support the same load and the tension will be the same. When the film retards, the first loop 160 of a series is shortened, and the tendency is for it to carry most of the weight and for the tension therein to increase; however, the individual roller of this loop will rotate slower and feed therefrom at a much slower rate than the film is fed thereinto. Likewise, the next series of rollers will rotate slower and so on until the weight is supported by all of the loops of this series of rollers, and the tension in all of these loops is the same. This readjustment acts very quickly. When my invention is incorporated in a

film developing machine of this character, the shrink and stretch of the film will have no detrimental effect on the film or upon the operation of the machine. When the film stretches at any place it is quickly compensated for and there will be no danger of the film running off the spools. When the film shrinks at any place, the increase in tension is quickly compensated for and the strain on the film is immediately reduced and a danger of shrinkage thereof is eliminated. The feature of separate spools is important as it serves to distribute the weight equally to all the loops of a series of rollers, thus equalizing the tension of each loop; therefore, the film in each series of rollers is at the same tension and the loops of film of each of the series of rollers is also at the same tension.

I claim as my invention:

1. In a film developing apparatus, the combination of: a drive roller; means for rotating said drive roller; a driven floating roller, there being a film wound around said drive and driven rollers; means for controlling the rate of rotation of said drive roller, said control means having a brake arranged to engage said drive roller; and a member energized by movement of said floating roller relative to said drive roller to actuate said control means, thus operating said brake.

2. In a film developing apparatus, the combination of: a drive roller; means for rotating said drive roller; a driven floating roller arranged below said drive roller, there being a film wound around said drive and driven rollers; means for controlling the rate of rotation of said drive roller; and a member energized by movement of said floating roller relative to said drive roller to actuate said control means so that the rate of rotation of said drive roller is reduced when said floating roller moves toward said drive roller.

3. In a film apparatus of the class described: a series of drive rollers; means for rotating said drive rollers; driven rollers, one of which is disposed beneath each drive roller to form therewith a pair of rollers, said driven rollers being movable vertically; a film passed consecutively about said pairs of rollers so that a variation in the length of the portion of said film passed about a given pair of rollers will cause a vertical movement of the driven roller of said pair; and means susceptible to the vertical movement of said driven rollers to control the speeds of rotation transmitted by said rotating means to said drive rollers, the rising of a driven roller of one of said pairs of rollers affecting said control means to decrease the speed of the drive roller of that pair, while a lowering of said driven roller affects said control means to decrease the

speed of the drive roller of a preceding pair of rollers.

4. A combination as in claim 3, in which said control means has lost motion giving freedom to said driven rollers for a limited distance of vertical movement within which said control means is inoperative to affect the speed of rotation transmitted to said drive rollers.

5. In a film apparatus of the class described, the combination of: a plurality of upper roller shafts; means for rotating said upper roller shafts; a roller carried and frictionally driven by each of said upper roller shafts; a brake shoe adapted to operate on each of said upper rollers; a lower roller disposed below each of said upper rollers; a brake actuator for supporting each of said lower rollers, each of said brake actuators being adapted to operate a brake shoe above the lower roller supported thereby and the brake shoe of a preceding brake; and a film extending over said upper and lower rollers, said lower rollers being raised when the tension in said film increases, thus applying a brake shoe of an exhausting upper roller situated thereabove, and said lower roller being lower when the tension of said film decreases, thus applying a brake of a preceding upper roller.

6. In a film apparatus of the class described, the combination of: a plurality of upper roller shafts; means for rotating said upper roller shafts; a roller carried and frictionally driven by each of said upper roller shafts; a brake shoe supporting bar disposed below each of said upper rollers; a brake shoe carried by each of said brake shoe supporting bars, each of said brake shoes being adapted to operate on an upper roller; a brake shoe actuator carried by each of said brake shoe supporting rods, each of said brake shoe actuators being connected with the brake shoe located above the brake shoe supporting rod carrying same in such a manner as to apply said brake shoe thereabove when said brake shoe is depressed, and being connected with the brake shoe of a following upper roller in such a manner as to apply same when said brake shoe actuator is elevated, the rotation of said upper rollers being retarded when said brake shoes are applied; a lower roller arranged below each of said upper rollers, each of said lower rollers being supported by the brake shoe actuator of a preceding lower roller; and a film wound on said upper and lower rollers, an increase of tension in said film at any point raising an adjacent lower roller, thus applying a brake shoe operating the upper roller thereabove so as to retard same and to decrease the travel of said film thereat, and a decrease in tension lowering said brake shoe actuator in a manner to apply a brake shoe of the preceding upper roller,

thereby retarding the travel of said film at this point.

7. A combination as defined in claim 6 in which each of said actuators is connected to said brake shoe thereabove by a block attached to said brake shoe and a rod attached to said brake shoe actuator, said rod extending into an opening in said block and said rod being arranged to engage said block in a manner to apply said brake shoe to which said block attaches when said brake shoe actuator is elevated; and in which each of said actuators is connected to a preceding brake shoe by an adjustable engager which engages a lug formed on said brake shoe, when said brake shoe actuator is depressed.

8. In a film apparatus of the class described, the combination of: a plurality of upper shafts; means for driving said shafts; a sleeve carried on each of said shafts, said sleeves being frictionally driven by said upper shafts; upper spools rotatable on said sleeves; a lower shaft arranged below each of said upper shafts; lower spools rotatable on said lower shafts; a film extending over said upper and lower spools; and means for maintaining the tension of said film at a normal tension.

9. In a film apparatus of the class described, the combination of: a plurality of upper shafts; means for driving said shafts; a sleeve carried on each of said shafts, said sleeves being frictionally driven by said upper shafts; upper spools rotatable on said sleeve; a lower shaft arranged below each of said upper shafts; lower spools rotatable on said lower shafts; a film extending over said upper and lower spools; a brake for each of said sleeves, said brakes adapted for actuation in such a manner as to retard the rotation of sleeves; and means for actuating said brakes when the tension of said film becomes abnormal so as to rectify said tension.

10. In a film apparatus of the class described, the combination of: a plurality of upper shafts; a sleeve carried on each of said shafts, said sleeves being frictionally driven by said shafts, and each of said sleeves having a brake drum and a drive spool; upper spools rotatably carried by said sleeves; a brake shoe adapted to engage each of said brake drums of said sleeves so as to retard the rotation thereof relatively to said upper shafts; a brake actuator associated with each of said brake shoes, said brake actuators being adapted to actuate said brake shoes; a lower shaft supported by each of said brake actuators; lower spools rotatably carried by each of said lower shafts, said spools and lower shafts being movable in such a manner as to operate said brake actuators; a film wound

around said drive spools, said upper spools and said lower spools, a variation in tension in said film being effective in moving said lower spools and said lower shafts so as to actuate said brake shoes in such a manner as to change the rotational speed of said sleeves, thus returning said film to normal tension.

11. In a film apparatus of the class described, the combination of: a plurality of upper shafts; a sleeve carried on each of said shafts, said sleeves being frictionally driven by said shafts, and each of said sleeves having a brake drum and a drive spool; upper spools rotatably carried by said sleeves; a brake shoe adapted to engage each of said brake drums of said sleeves so as to retard the rotation thereof relatively to said upper shafts; a brake actuator arranged below each of said upper shafts, each of said brake actuators being arranged to actuate a brake shoe thereabove and to actuate a following brake shoe; a lower shaft supported by each of said actuators, said lower shafts being movable in such a manner as to move said brake actuators, thus actuating said brake shoes; lower spools rotatably carried on said lower shafts; and a film wound on said drive spools, said upper spools and said lower spools, said lower spools and said lower shafts being raised when the tension in said film increases, thus applying the upper brake shoes, and being lowered when said tension in said film decreases, thus applying the following brake shoes, thereby returning said film to normal tension.

12. In a film developing apparatus, the combination of: drive rollers; means for operating said drive rollers; driven floating rollers, there being a film wound around pairs of drive and driven rollers; means operated by the vertical movement of said driven rollers for reducing the rate of rotation of the drive rollers when the driven roller of the same pair is raised; and means operated by said first named means for permitting a preceding drive roller to rotate at a greater rate of rotation when a following driven roller is raised.

13. In a film developing apparatus, the combination of: drive rollers; means for operating said drive rollers; driven floating rollers, there being a film wound around pairs of drive and driven rollers; and means operated by the vertical movement of said driven rollers for increasing the rate of rotation of a preceding drive roller when a following driven roller is raised.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 23rd day of February, 1926.

FRANK E. GARBUTT.